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ABSTRACT

The decision by New York State educators to create a new area of study and to require it of all students grew out of the realization that technology pervades almost every aspect of life. Technology education prepares students to use technology and offers the means to assess and influence the impact of technology on society and the environment. It is a hands-on instructional program that inculcates higher-level thinking processes. One unique aspect is the laboratory-based Technology Learning Activity, in which tasks and learning are matched to specific objectives in the course syllabus. The purpose of the technology education program is to make all New York State students technologically literate. Technology education evolved from the industrial arts curriculum, which was substantially revised to reflect the mission of the new discipline. By the end of eighth grade, all New York State students must complete Introduction to Technology. At the high school level, technology education is an elective subject. Technology education courses provide students with a broad base of skills and competencies. Examples of courses specifically designed to improve competitiveness in the global marketplace include Creativity and Innovation, Design and Drawing for Production, and Introduction to Engineering. (YLB)

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TECHNOLOGY EDUCATION

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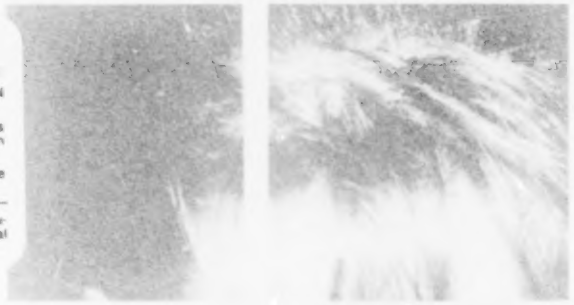

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A NEW BASIC FOR THE 21st CENTURY

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technology–the use of accumulated human knowledge to process resources to satisfy human needs and wants.

technological literacy–the ability to interact successfully with technology, to assess the impacts of technology on everyday life, and to apply conceptual knowledge in order to solve problems.

Technology Education–an integrating discipline designed to develop technological literacy as part of all students' fundamental education through an activity-based study of past, present, and future technological systems; their resources, processes, and impacts on society.

TECHNOLOGY EDUCATION – THE ROUTE TO ECONOMIC COMPETITIVENESS

An exciting new subject is being taught in New York State schools — TECHNOLOGY EDUCATION. By the end of grade eight, all students must have completed the introductory course in Technology Education. Elective courses in high school Technology Education can fulfill sequence requirements for graduation. Technological literacy is a "new basic" for education, necessary for students who will be living and working in the 21st century.

The decision by New York State educators to create a new area of study and to require that all students take it grew out of the realization that technology pervades almost every aspect of our lives. The effects of technology are so interwoven with the fabric of daily life in the United States that it is nearly impossible to exist without some degree of technological contact or dependence.

Our new age of information and technology demands a more highly educated populace and work force, able to understand the technical complexities which dominate our culture. For the United States to remain competitive in world markets, its citizens must be more conversant with technology than ever before.

School is the ideal place to begin to foster an understanding of technology and the role it plays in shaping our culture. Technology Education accepts as its major role providing students with technological capability to ensure their future success and our nation's preeminence.

TECHNOLOGY IN OUR WORLD

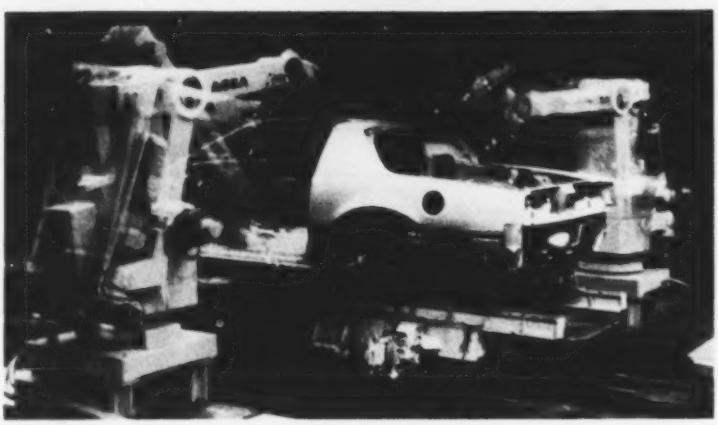
Although technology has been a powerful force in the service of humankind since prehistoric times, it has never been as pervasive an influence on human culture as it is today. Distant journeys are completed in a matter of hours. Global communication is immediate. Digital computers, word processing, satellite communications, robotics, lasers, programmable ovens, and space shuttles attest to the profound changes brought about by technology in a very short period of time. The microelectronics industry, which did not exist 30 years ago, is expected to be the world's fourth largest industry by 1990.

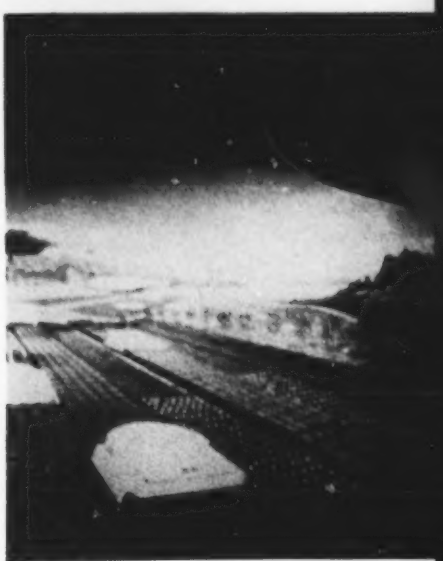
Many areas of work have become more technologically based. Office workers, medical personnel, and auto mechanics find their jobs increasingly permeated by technology. At all levels of employment, technology is profoundly influencing how work is done.

In an era when the world has become more and more dependent on technical solutions to problems, Technology Education is providing students with technological literacy as part of their fundamental education. Controversial issues debated in Congress and discussed in the media increasingly involve a technological component. Genetic engineering, acid rain, organ transplants, nuclear power, and sophisticated weaponry are a few examples. In order to comprehend these issues and make intelligent decisions, people of all ages and educational levels need to be technologically literate.

Students should learn at an early age that technology is a human endeavor, that people can and must control the development and application of technology. Whether technology is used to benefit or harm society is entirely a human decision.

By preparing students to use technology and by offering the means to assess and influence the impact of technology on society and the environment, Technology Education provides an essential part of education.





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MIDDLE/JUNIOR HIGH SCHOOL SAMPLE TLAs

- Early Technical Devices
- Logo Design and Production
- Energy Transfer Device
- Load-Bearing Structure Design Problem
- Plants with One Parent
- Simulations and Modeling
- Basic Security and Detection Systems
- Production Systems
- Hydroponic Greenhouse
- Habitats in an Alien Environment
- Producing and Marketing Pharmaceutical Products
- Controlling Technological Systems
- Future Visions: Becoming Part of the Solution
- Computer Control
- Clean the Air
- Telecommunications Systems

WHAT IS TECHNOLOGY EDUCATION?

Technology Education is a hands-on instructional program which inculcates higher-level thinking processes. Using such skills as problem-solving, creative and critical thinking, and decision-making, students research, design, engineer, and test devices and systems in order to solve practical problems. Management skills are also inculcated in many of the projects, as are opportunities to develop leadership skills.

Along with its emphasis on reasoning skills, Technology Education focuses on teaching broad concepts and principles. Technology is changing so rapidly that it is impossible to design an educational program to meet specific future needs. What students must have is a foundation of knowledge that will help them adapt to an ever changing world. Skills, knowledge, and attitudes acquired in Technology Education are applicable to many types of jobs and provide students with the flexibility needed to make future career changes as well.

Hands-on learning activities are a critical component of Technology Education. Technolcgy Education programs are designed to assist all students in discovering their technical interests and capabilities. In laboratories containing a variety of machines, tools, work surfaces, and materials, students speculate, experiment, and investigate. Innovation is encouraged.

One unique aspect of Technology Education instruction is the Technology Learning Activity (TLA). Each TLA is a laboratory based activitiy in which the tasks and learning are matched to specific objectives in the course syllabus. Thus, students studying how information is processed might be involved in digitizing images of their own or classmates in a desk-top publishing activity.

Technology Learning Activities also identify interdisciplinary relationships with other areas of study. Since technology uses information from many fields of knowledge, Technology Education integrates concepts and theories of such subjects as math

and the natural sciences. The relationships of technology to individual lives, society, and the environment help to reinforce social science concepts. Thus, Technology Education establishes connections for students between theoretical concepts and their practical applications while providing genuine interdisciplinary connections to other school subjects, the world of work, and life's experiences.

All New York State Technology Education courses use a systems approach based on elements (inputs, processes, outputs, feedback and control) common to all technological systems. Once students understand the similarities that exist among all technological systems, they can begin to look for familiar patterns in unfamiliar technologies.

Technology Education is for all students. Students with handicapping conditions participate in instruction and activities to the fullest extent allowed by their conditions. Every curriculum document includes suggestions for modifying instructional techniques and materials to assist teachers in working with students with handicapping conditions. The diverse nature of technological endeavors permits active roles for students with a variety of interests and abilities.

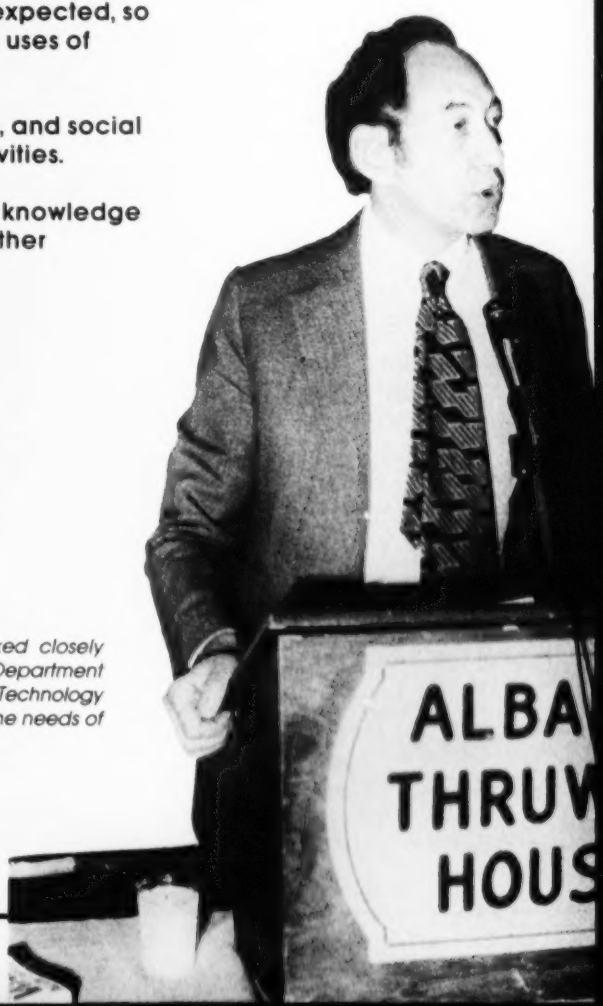
HIGH SCHOOL SAMPLE TLAs

- Analysis of Television Commercials: Scripts and Storyboarding
- Introduction to Video Recording through Animation Techniques
- A Team-Produced Public Relations Campaign
- Computer Imaging for Graphics: Digitized Images
- Telecommunications
- Propeller-Driven Land Vehicles
- Experimental Hovercraft
- Car-Builder: A Simulation of Land Vehicle Subsystems
- Testing Marine Vessel Hulls
- Solo Flight: A Basic Flight Simulator Program
- Testing and Installing Types of Insulation
- Thermal, Chemical, and Mechanical Conditioning
- Concrete Testing
- Residential Flooring Systems
- Geometric Construction
- Biogas Generation
- Modeling Bridge Designs

GOALS OF TECHNOLOGY EDUCATION

The purpose of the Technology Education program is to make all New York State students TECHNOLOGICALLY LITERATE. Technology Education achieves this goal by helping students to:

1. **Explore areas of technology in order to discover technical abilities and career interests.**
2. **Develop skill in the use of technological tools and systems.**
3. **Apply problem-solving techniques in the search for solutions to technological problems.**
4. **Understand resources, processes, and outputs as they relate to technology and recognize that these elements are common to all technological systems.**
5. **Recognize that technology can have consequences that are desired, undesired, expected, or unexpected, so that they can exercise some control over the uses of technology.**
6. **Synthesize learning of mathematics, science, and social studies concepts through technological activities.**
7. **Acquire broad-based, transferable skills and knowledge which will be useful in future employment, further education, and life's experiences.**



Futurist Alvin Toffler worked closely with the New York State Department of Education to match the Technology Education curriculum to the needs of future students.

THE EVOLUTION OF TECHNOLOGY EDUCATION IN NEW YORK STATE

New York State has been providing national leadership in the development of Technology Education. In 1981, the New York State Education Department undertook the task of reviewing and revising educational programs in light of the major technological, demographic, economic, and social changes in society. A "Plan for Futuring of Occupational and Practical Arts Education" was developed and a Futuring Committee was established for each instructional area.

Industrial Arts was examined by a committee representing business, industry, and the professions as well as education. Over a two and a half year period, the representatives studied trends to reveal what changes needed to be made to prepare students for the future. The Futuring Committee concluded that the Industrial Arts curriculum should be substantially revised and that the name should be changed to Technology Education to reflect the mission of the new discipline.

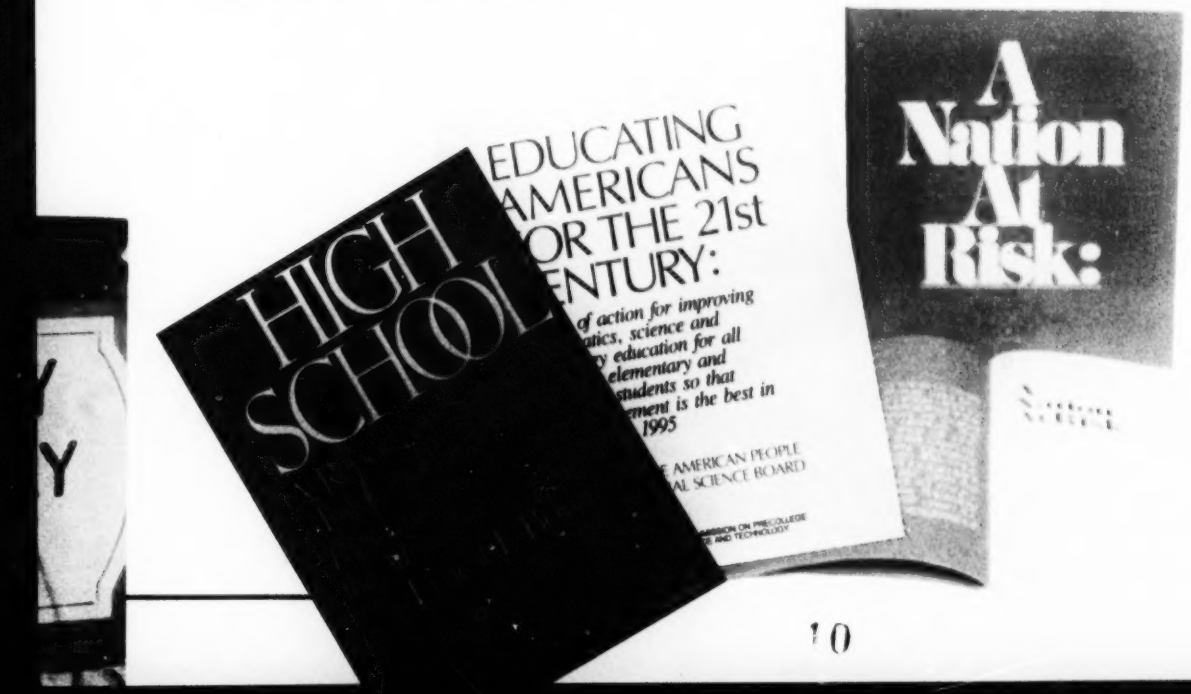
As the Futuring Committee deliberations proceeded, the New York State Board of Regents and the Education Department began a comprehensive review of the goals of elementary and secondary education in the state. This review culminated in March 1984 with the publication of the Regents Action Plan. The Plan set new standards and expectations for education in New York State. Among its mandates, the Plan requires that every student complete one year of Technology Education by the end of grade eight.

The Futuring recommendations and those of the Regents were in harmony with many of the national reports on education published in the first half of the 1980s. In a 1983 report entitled *Educating Americans for the 21st Century*, the National Science Board Commission said:

> The condition of mathematics, science, and technology education reveals an apparent misperception by the public that adequate course work need only be provided to students preparing for college level study in these fields and that these courses are unnecessary for other students. This misperception about the mathematics, science, and technology training needed by students in our schools is tragic for our society as a whole.

The Board also stated its commitment to increasing the "general mathematics, science, and technology literacy of all citizens for life, work, and full participation in the society of the future."

The Report of the National Commission on Excellence in Education, *A Nation at Risk*, likewise indicated that the United States is in danger of "losing its preeminence in science and technological innovation."



HOW STUDENTS LEARN ABOUT TECHNOLOGY

New York's 7th and 8th graders are learning about technology through activities like these:

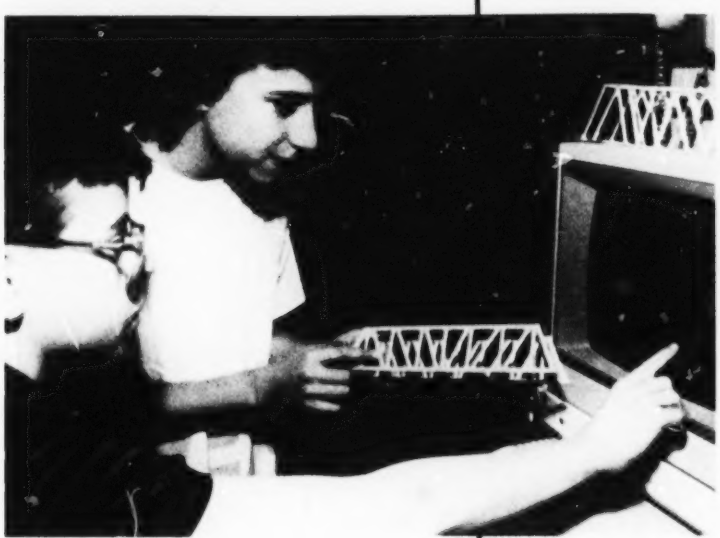
- designing and constructing battery-powered model vehicles with sensing devices that allow them to avoid obstacles.
- using a computer to operate a robot.
- designing and building prototypes of air-powered vehicles, such as elevators and rocket launchers, to demonstrate basic principles of pneumatics.
- constructing and operating hydroponic systems to grow edible plants without soil.
- using laser equipment to transmit an audio message to a distant receiver and speaker.

The Technology Education program which all New York State students must complete by the end of eighth grade is called Introduction to Technology. Schools typically offer a half year of the course in grade seven and a half year in grade eight, although some schools may begin instruction in grade six.

The seventh grade curriculum introduces students to the major branches of technology — physical, biological, and information—and to the various resources that are needed for technological activity. Students study the systems and subsystems of technology and practice problem-solving techniques. As they examine how technology affects people and the environment, students discover that technology can have both expected and unexpected impacts. With this discovery comes the realization that people can and should control technology.

In grade eight, students learn how to choose appropriate resources and how to convert them to their most useful forms. They study control of technological systems by using sensing devices to monitor output. Examination of the social aspects of technology leads to consideration of such matters as the development of new industries, changing career opportunities, and the importance of adaptability. Finally, students practice using technological systems to solve problems in all aspects of technology.

As with all Technology Education courses, Introduction to Technology is designed to be taught through instructional strategies that are 75 percent hands-on, laboratory based activities. Students have opportunities to learn from their mistakes, to solve problems through such techniques as analysis, modeling, and trial and error elimination, and to propose creative, innovative, nontraditional solutions to technical problems. Development of mental process skills is bolstered through these experiences in the Technology Education laboratory.



At the high school level, Technology Education is an elective subject. Students may also choose to take a sequence of Technology Education courses, thereby fulfilling specific New York State graduation requirements. The broad range of courses is designed to appeal to students with varying interests and career aspirations.

Certain high school Technology Education courses have been designated as Foundation courses: Electricity/Electronics, Energy, and Technical Drawing. Three courses are offered as Systems courses: Production Systems, Communication Systems, and Transportation Systems. Students electing a sequence in Technology Education must take two courses from each group. Most high schools offer at least these courses, and many schools make a number of other Technology Education electives available to students as well.

All high school offerings in Technology Education build on the skills and knowledge acquired by students through participation in Introduction to Technology. Hands-on activities in well-equipped Technology Education laboratories continue to be the mainstay of instruction.

Ideally, Technology Education should begin in elementary school. At this level, projects and activities can serve to reinforce other disciplines by relating them to content in those subject areas.

HIGH SCHOOL COURSES IN TECHNOLOGY EDUCATION

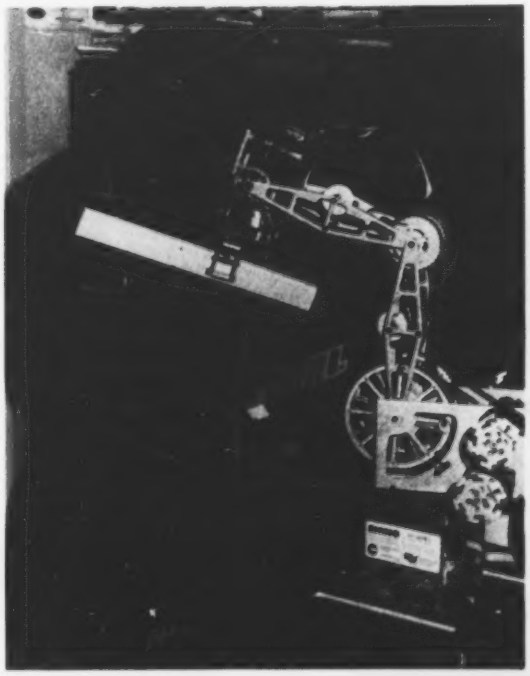
- Aerospace
- Architectural Drawing
- Audio Electronics
- Communication Electronics
- Communication Systems
- Computer-Aided Design
- Computer-Aided Manufacturing
- Computer Applications
- Computer Graphics
- Creativity and Innovation
- Design and Drawing for Production
- Digital Electronics
- Electricity/Electronics
- Energy
- Energy Applications
- Graphic Communications
- History of Technology
- Introduction to Engineering**
- Land Transportation
- Materials Processing
- Photography
- Production Research and Development
- Production Systems
- Residential Structures
- Technical Drawing
- Transportation Systems

**under development

TECHNOLOGY EDUCATION AND FUTURE CAREERS

Leaders in business and industry have advised the New York State Education Department that future employees should be prepared with transferable skills in order that they be adaptable. Technology Education programs focus on concepts generic to a broad array of technologies. Problem solving, decision making, system analysis, group work, communication skills, and human relations are also stressed at all levels.

Courses are intended to provide students with a broad base of skills and competencies so that they may pursue careers in a wide variety of technological areas. Students participating in high school Technology Education programs receive an excellent foundation which leads to further education in engineering and technology, to careers as technicians, and to vocational training. Many of the most promising and lucrative jobs in the future will require technological capability.



FOCUS ON INNOVATION

Technology Education courses have been specifically designed to improve our capacity to compete in a global marketplace through the use of creative approaches to technological development. The following are examples:

FOUNDATION COURSES (Technical Drawing, Electricity/Electronics, Energy)

In generating technological solutions, a set of foundation skills can provide tools for future technologists. The skills and concepts learned through the study of Technical Drawing, Electricity/Electronics, and Energy comprise a base of fundamental knowledge which can be applied to designing a broad spectrum of technological subsystems.

SYSTEMS COURSES (Communication, Production, and Transportation Courses)

From earliest times, people have employed systems of communication, production, and transportation to adapt their natural environments to conform to human needs and wants. These systems are universal and exist in all cultures, whether primitive or modern. Technology Education teaches students about the commonalities among all technological systems. Students apply problem-solving techniques in their search for solutions to technological problems within each of these major systems.

CREATIVITY AND INNOVATION

Creativity is the spark that fires the engine of technological innovation. It is within our capability to prepare our youth to become creative and innovative problem-solving adults. *Creativity and Innovation* is an exciting half-year course which stimulates original and divergent thinking in our students and applies these techniques to the solution of technological problems.

Creativity and Innovation has received the endorsement of the United States Commissioner of Patents and Trademarks. It has become a part of the national Project XL, whose objective is to insure our nation's position as a world leader as we enter the 21st century.

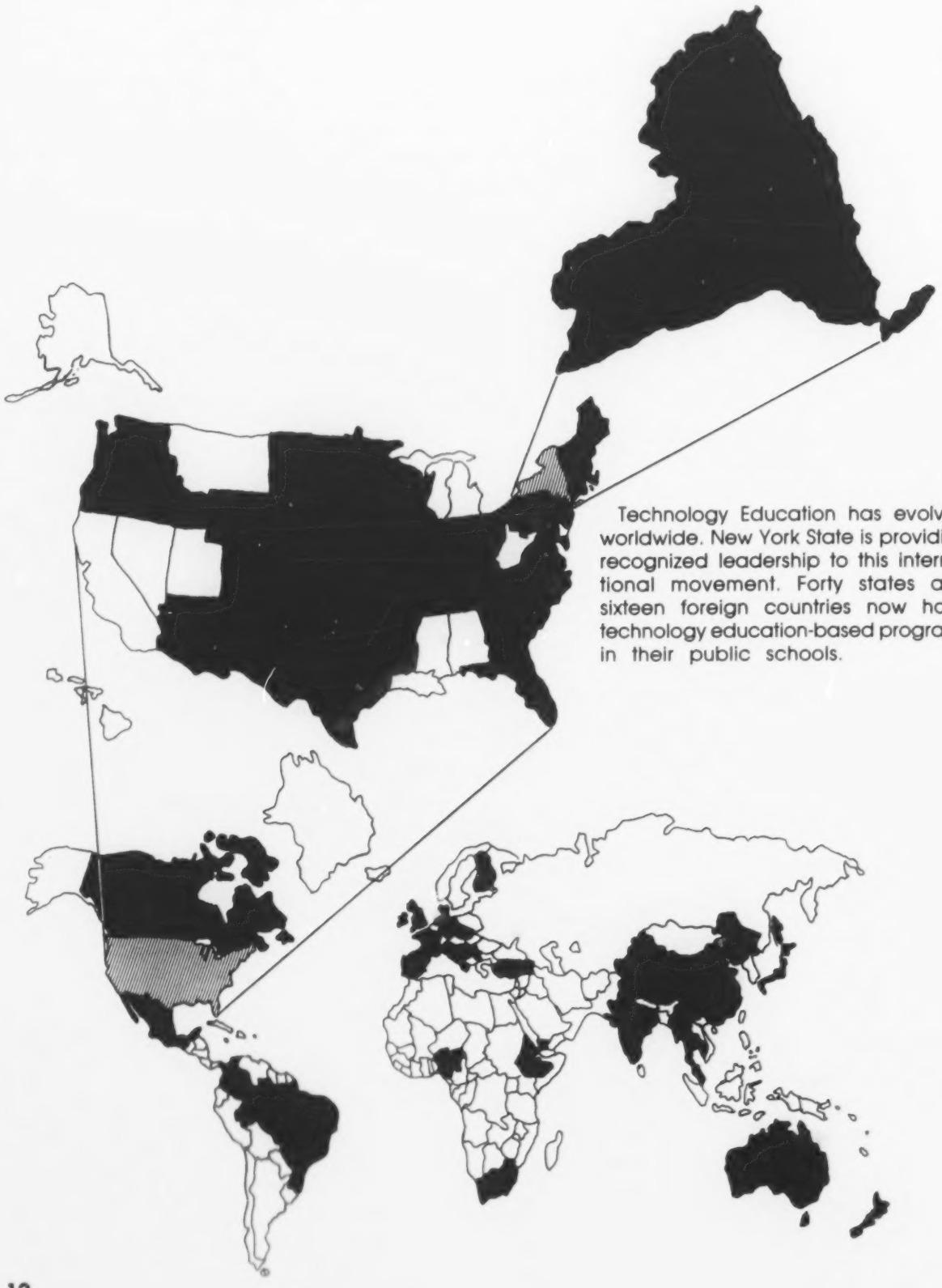
DESIGN AND DRAWING FOR PRODUCTION

This course is a year-long introduction to a universal language through which students can express their ideas with creativity, clarity, and exactness. Designing and drawing for production are vehicles for world-wide industrial communication and integral steps in the process of product design and production. *Design and Drawing for Production* deviates from the traditional methods of drawing in that students are presented with problems and their ramifications and are challenged to find graphic solutions.

INTRODUCTION TO ENGINEERING

In Japan, 40 percent of graduates receive degrees in science and engineering. In the United States, only 8 percent of degrees granted are in those fields. In an increasingly technological society, more highly qualified engineers will be needed.

Introduction to Engineering is a one-year course designed by members of the Engineering Societies, university engineering school professors, and high school Technology teachers. The course introduces students to the "method" of engineering (the process engineers use to design and optimize solutions). Through a variety of hands-on activities, students are introduced to careers in chemical, civil, electrical, and mechanical engineering. The social impacts of engineering decisions are stressed.



Technology Education has evolved worldwide. New York State is providing recognized leadership to this international movement. Forty states and sixteen foreign countries now have technology education-based programs in their public schools.

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Nowhere is the movement more advanced than in New York – the only state that requires all junior high school students to take a one-year introductory technology course.

CURRICULUM DEVELOPMENT AND INSERVICE TRAINING

Creating a new curriculum for Technology Education and helping teachers learn how to teach it were enormous undertakings for the state of New York. Teachers and other school and college personnel, consultants from across the United States, business people, industrialists, and New York State Education Department staff members spent three years developing the middle school and high school curriculum. Extensive inservice education acquainted teachers with the new conceptual base for their discipline and with the new content, courses, and instructional procedures.

Technology Education offers excellent career opportunities for people who enjoy technical pursuits and want to share their knowledge with others. More Technology Education teachers are urgently needed in New York State.

Technology Education is an educational response to societal change, and is truly a new basic for the 21st century.

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1993	Laura Bradley Chodos, B.A., M.A.	Vischer Ferry
1991	Louise P. Matteoni, B.A., M.A., Ph.D.	Bayside
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